Ernest Mandel and the Pulsation of History*

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Ernest Mandel's *Long Waves of Capitalist Development* was his last major theoretical work. The second edition of the book (1995), which includes two new chapters added to the first English edition (1980) dealing with the current state of the debate, was finished and published very shortly before the author's death in July 1995. This text is the culmination of thirty years of research on a subject which was largely redefined and shaped by Mandel: his arguments, including the polemical tone appreciated by those who knew him, synthesize a broad view of the evolution of capitalism as a civilization, namely of its main economic and social trends, and its interrelation with the political factors in historical perspective.

Mandel's first article on the subject dates from 1964 and was first published in *The Socialist Register*. His general and innovative appraisal of Marxian economics, *Traité d'Economie Marxiste* (in English: *Marxist Economic Theory*) had just been published two years before, but the long periods of the history of capitalism were not considered in that book: business cycles are explained in the *Traité* following Marx's concept of the echo-cycle of investment and no other periods are discussed. The particular feature of the 1964 article was the broadening of that perspective and the consideration of the contributions of three decisive authors who established the preliminary version of the research agenda on long waves: Kondratieff (namely with his 1922, 1924 and 1926 papers and the debate at the Conjuncture Institute of Moscow, published in 1928),[1] Trotsky (namely with his 1921 report to the conference of the Comintern and his 1923 polemic with Kondratieff)[2] and Schumpeter (mainly with his 1939 book *Business Cycles*, but also with some papers published since the end of the twenties).[3]

In 1964, Mandel suggested a new theory based on these contributions, and predicted that the 'thirty golden years' of the post-war boom could be expected to end soon. These two topics then became the most relevant part of his subsequent research. Some time later on, he wrote *Late Capitalism* (published originally in German in 1972), which is the most important piece in the revival of the discussion among Marxists on the Kondratieff waves. It is indeed his magnum opus, comprising a global analysis of capitalism and of its structural changes during the fourth long wave, the one that began after the Second World War. This book was summarized and developed in the Alfred Marshall Lectures delivered by Mandel in 1978 at the invitation of the University of Cambridge, which constitute the first four chapters of *Long Waves of Capitalist Development.*

In 1989, Mandel organized a conference in Brussels, in collaboration with Alfred Kleinknecht and Immanuel Wallerstein, which represented the most important recent effort to synthesize and relaunch the research on long waves. His contribution to that conference, 'The International Debate on Long Waves of Capitalist Development: An Intermediary Balance Sheet', was elaborated in the two chapters prepared for the second English edition of the *Long Waves* book (1995). The historical theory, the definition of the method of research and the critique of orthodox economics were extended in what constitutes a major contribution and a successful challenge to the traditional interpretations of economic and social development and change. The evolution of that research programme is the theme for the following pages.

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* chapter 6 of Gilbert Achcar (Ed.), *The Legacy of Ernest Mandel*, Verso, 1999.

The origins of the research programme

The research programme on long waves was established simultaneously by several political activists and academic writers who interpreted the distinctive periods of acceleration and deceleration of growth in the nineteenth century: Parvus (main paper, 1901) and Van Gelderen (1913) were active members of the early social-democratic movement, while Bresciani Turroni (1913, 1916), Pareto (1913) and Tonelli (1921) were engaged in academic research. In spite of such diversity, all these authors agreed on two crucial points: the chronology of the long periods of expansion and contraction, and a perspective combining social, political and economic factors. For Pareto, the long cycles were characterized by conflicts inside the ruling elite, namely the succession of periods of domination by speculators and rentiers; for Turroni and Tonelli, just like for Parvus and Van Gelderen, the social struggles and the schedule of the profit rate were inseparable.

These distinctive features placed the programme on the margin of or in opposition to the new-born neoclassical economics (in which the same Pareto played a major role), since the former was concerned with economic mutations and switches of regimes, and not with some metaphysical gravitation towards equilibrium. In other words, the research programme on long waves was historical by nature and reflected the epistemological requirements of a realist approach to economics, while mainstream economics has been based on the Newtonian properties of an atomist universe where the movements of prices carry all information and encapsulate the natural tendency for equilibrium. Moreover, the idea of convergence and harmony in laissez-faire society described by Mandeville in his *Fable of the Bees* was challenged by the inclusion of political perturbations and social struggles.

Van Gelderen, author of the most precise and complete introduction to the research,[4] insisted particularly on such an articulation of factors, which are to any mainstream economist the definitive proof of the eclecticism and irrelevance of the programme. Kondratieff, who began studying the subject in 1922 and ignored Van Gelderen's contribution, got to the same conclusion and presented a new formulation for an integrated approach of the long periods. Nevertheless, his specification of the 'long cycles' was intensely discussed by two main contenders, Trotsky and Oparin.

Trotsky's speech at the 1921 Comintern conference, acknowledging the existence of different stages and conjunctures of capitalist development, is indeed the first piece of the Russian debate. Having known and cooperated with Parvus, Trotsky was certainly aware of his concept of the *Sturm und Drang* periods of capital expansion and subsequent periods of depression.[5] His intervention was implicitly based on that concept, challenging the ultraleftist position of Bela Kun and the leadership of the German KPD; Kun and the KPD supported the thesis of an imminent revolution and consequently called for offensive action on the basis of the imminent collapse of capitalism.

As Kondratieff's first essay on the 'Long Cycles of the Conjuncture' appeared in 1922, the author was probably convinced that his description and hypotheses were largely shared, and could not hide his surprise when Trotsky sharply criticized his text. In his article of summer 1923, Trotsky used data from the London *Times* to argue that the 'curve of capitalist development' changed abruptly from time to time[6] under the impact of exogenous events, namely revolutions, wars or other political mutations. As a consequence, Kondratieff was criticized for his attempt to endogenize all the political factors, i.e., for ignoring the autonomy of social processes in relation to the economic sphere. In fact, at that time Trotsky was engaged in another political battle, against Bukharin and the idea of a perpetuation or stabilization of the capitalist system. Trotsky rejected the notion that the economy could

adjust automatically to upswings and downswings without regard to the strategic dimension - as in Kondratieff. Yet both the 1921 and the 1923 positions were coherent: for Trotsky, major political (exogenous) events determined both the upswing and the downswing of the long wave, which was nothing less than an important change in the trend of the economy. During the maturation of the social conditions of each period, the political factors were supposed to be constrained by the whole dynamic, until the internal contradictions allowed for a new rupture in the 'moving equilibrium'.

Kondratieff was apparently surprised by the critique and in his defence quoted the 1921 speech by Trotsky. Nevertheless, he did not pursue the matter, developing his own positions and trying to avoid any direct political implications. During the 1926 debate at the Institute, such interpretations were scarcely noted. As opposed to Trotsky, Kondratieff argued that the whole dynamic was endogenously determined by the economic contradictions, which indeed included and determined the political factors.

The second main critique was developed by Oparin, a researcher at the Moscow Conjuncture Institute directed by Kondratieff, who presented a counter-report to the 1926 seminar. The main point, of that debate concerned the statistical method used to detect long waves. Basically, Kondratieff used several different types of functions to represent the trend line, and considered the trend-deviations as the evidence to be inspected for the existence of long fluctuations. Oparin rightly criticized the arbitrariness of the choice of the functions, but his own alternative was easily dismissed by Kondratieff, since it was based on the assumption of the existence of a number of discrete points of equilibrium and of the existence of a 'natural' rate of growth of gold reserves, as asserted by the early monetarist theory of Cassel.

Shortly afterwards Kondratieff was removed from his position, incarcerated near Moscow and later shot on Stalin's orders. Some of his writings from prison, dealing with general methodological issues, were published in Russia only in 1992 and still await translation. There was then a long interruption in the research, with rare exceptions (e.g., Imbert, Dupriez), until the revival of the research under the influence of Ernest Mandel in the sixties.

Mandel's contributions

When reassessing this debate, Mandel suggested a new hypothesis which was at the core of his research: the internal contradictions of the capitalist mode of production account for the turning point from expansion to depression, but systemic shocks, i.e., exogenous factors propagated through the economy, are needed in order to generate a new phase of expansion. This is not a synthesis of Trotsky and Kondratieff, but in fact a new and original theory, which is rather distinct from the previous ones. It incorporates the autonomy of the political and social processes and yet does not abandon the requirement for the formulation of economic laws (or tendencies) as the expression of the dialectics of capitalism.

In doing so, Mandel was one of the first authors in the research programme on long waves to consider the necessity for a historically integrated explanation, and in fact to define it as the very condition for the viability of the programme. The large majority of the researchers based their inquiries in smoothing techniques derived from trend- deviation analysis and in transforming data in order to decompose the series in a trend and cyclic movement (like Kondratieff, Oparin, Kuznets, Imbert, Dupriez, Duijn, Kleinknecht, Menshikov, Ewijk, Zwan, Hartman, Metz, Reijnders, et al.).

Others abandoned the domain of data analysis and suggested that model simulation could replace the inductive proof (Forrester, Sterman, Mosekilde, et al.). The exceptions have been Gordon (and the first works of the Social Structures of Accumulation school), some of the

French Regulationists, Shaikh, Wallerstein, Freeman, Perez, Tylecote, Rosier, Dockès, Kleinknecht and some historians of the phases of capitalist development like Maddison. In this group, Mandel stands as the first researcher to define the modern historical approach to the long waves.

There are two decisive reasons for privileging the historical approach in the analysis, as Mandel did. The first is imposed by the goal itself: long periods of development cannot be supposed to be permanently ruled by the same structural relations,[7] since the changes - the morphogenetic transformations of the social universe - are a permanent feature of the economies and include such diverse events and factors as technological innovation, modifications of the labour relations, political institutions, dimensions and structure of the market, evolving cultural characteristics or strategies by social groups. In these circumstances, the statistical approaches based on the premiss of equilibrium are doomed to fail: the trend-cycle decomposition which is the basis of the traditional econometric methods assumes independence between the two sets of phenomena and the principle of structural causal stability. Of course, neither of these hypotheses is acceptable in the analysis of real historical series. As a consequence, one must suspect that the inability of the traditional statistics to detect long waves is not a reflection of reality but rather imposed by the very methods used to inspect the data.[8]

The second major factor recommending the use of historical methods of analysis is that economic relations alone cannot completely or exhaustively account for long term changes. As Polanyi pointed out in his *The Great Transformation* (1944), the image of independence and mechanistic functioning of the economic sphere, imposing itself on the society, is an ideological projection of liberalism and a contractarian justification for its imperfect market; the powerful General Equilibrium paradigm is a feature of imagination and has no heuristic power whatsoever. In fact, economic relations are part of the complex social processes.

The whole debate about the endogeneity and exogeneity of the causal factors - which is briefly summarized in Mandel's book - proceeds from such an image and influenced the choice of methods for many researchers. For Kondratieff and for most of the long wave analysts, the perfect model of causality is the one which exhaustively discriminates the endogenous and exogenous variables and attributes the causal determination to the former. Such, a requirement was introduced in Kuznets's and Lange's review of Schumpeter's *Business Cycles* and was later stressed by other critiques of the programme. It is today accepted by most of its practitioners.

Nevertheless, this stance is internally self-contradictory. For if a completely endogenous explanation is presented, it amounts to the excessive claim that some economic function determines the major social events, wars and revolutions, as well as all political forces and the institutional environment itself. Explaining everything amounts to the recourse to an all-inclusive mechanism. As a consequence, the traces and impacts of those factors cannot and should not be meaningfully eliminated from the series, since they are supposedly part of the endogenous mechanism. But the researchers who use the trend-cycle decomposition methods are forced to do so, and mainly to eliminate the variations at the time of the two world wars, in order to detect long waves.[10] In that case the conclusion is contradictory and irrelevant. No claim can be made on reality if the proof is based on the statistical artefact which is a consequence of a procedure that eliminates part of history from the historical series.

On the other hand, the statistical decomposition of the series is inspired by the conception of the business cycle of Ragnar Frisch, who defined in a path-breaking paper of 1933 a model including an impulse system (the non-systematic or random shocks) and the propagation system (representing the systematic behaviour of a damping mechanism).[11] In order to

eliminate the excessive deviations caused by the wars in the real series, researchers following this method are forced to equate those events to the random and external forces hereby considered. Of course, this is just the opposite of declaring that those processes are mere consequences of the economic endeavour. Furthermore, in the positivist epistemology implicit in traditional econometrics, causality is defined by the nearer exogenous force, and thus wars or social conflicts should be considered and not ignored as explanatory variables.[12] But since the price of accepting such claims is the rejection of automatic cyclicity, some researchers prefer to live with the contradiction of claiming total endogeneity as the legitimate form of causality, exiling the badly behaved variables to the Purgatory of total exogeneity. Mandel's work suggests a way out of such self-defeating contradiction: a historical approach to the phases of capitalist development, rejecting the quest for certainty based on the ineffective attempts to prove statistically what traditional statistics are not able to recognize. Since the object is history, this seems to be sound wisdom.

'Parametric determinism' and semi-autonomous variables

Historical analysis can and should be developed in combination with rigorous statistical and formal methods. Beginning in *Late Capitalism*, Mandel argued for a particular articulation to be based on the concept of 'partially independent (autonomous) variables', which represent 'all the basic proportions of the capitalist mode of production',[13] namely the organic composition of capital (including the volume and distribution of capital), the structure of capital (the proportions of the fixed and circulating parts, and their distribution among branches), the rate of surplus value, the rate of accumulation (and the productive and unproductive consumption of surplus), the evolution of the periods of capital rotation, and the structure of the exchange between Departments I and II. This manifold of variables explains the movement of the profit rate, which is the essential cause of both the Juglar cycles and the Kondratieff waves.[14]

This conception involves a thorough reconsideration of the Marxian debates on the issue, since Luxemburg, Hilferding, Grossmann and Bukharin based their analyses of cycles on the reproduction schemes of *Capital* Mandel criticized such attempts, which are undermined by the equilibrium properties of the model and by the simplification of those schemes. For Mandel, if the economist is studying the inherent tendency towards ruptures of the equilibrium, the crucial interdependencies between causal factors as well as their partial autonomy may only be comprehensible in a concrete framework. In other words, history must be reconciled with theory: theory without history is mute and history without theory is blind.

Kalecki addressed a similar problem in one of his last papers, published in 1968, suggesting the concept of 'semi-autonomous variables' in order to represent forces which are exogenous from the point of view of the current mathematical models, but which are still in the framework of what should be explained by the theory.[15] Those variables explain in Kalecki's model the growth and the eventual changes of the economy, i.e., represent history. Abandoning the ambitious programme for the complete endogenization of causality, Kalecki's argument implies that no simple model with a small number of variables can faithfully represent reality. The study of the complexity of social relations requires flexible, partial and limited models, but also a general theory of the economic process in which those models and results are interpretable. But Kalecki did not develop the insight, although it is clear that many of the crucial variables in some of the most important economic models are of that kind.[10]

This is why Mandel's concept of the 'partially independent variables' is so important, since it develops for Marxism the central condition for the incorporation of history. Instead of the simplistic guess-work involved in formal models of three or four dimensions, history is assessed in its organic totality - processes and not equilibrium, change and not continuity,

dialectics and not causal invariance, concrete and total determinations and not abstract and totalitarian determinism, are at stake. In a biographic sketch prepared for the *Biographical Dictionary of Dissenting Economists* in the last years of his life, Mandel argued that one of his main contributions was the concept of 'dialectical (parametrical) determinism' as opposed to 'mechanistic determinism',[17] which characterizes general equilibrium economics and traditional econometric methods. This rupture is evidently inspired by his life-long opposition to unilinear and positivist Marxism, but incorporates as well the attempt to synthesize the system in which those semi-autonomous variables are modelled. Humanity poses the problems it is able to solve, and in those determinate boundaries occurs the conflict for control, for coordination and for power.[18]

This theme was already dealt with by Mandel in 1985, in a paper where he discussed the distinction between endogenous and exogenous variables. In his view, endogenous variables, from the economic point of view, are those describing the automatic processes flowing from the system's structure:

> These can determine the speed, direction, degree of homogeneity/ heterogeneity of the development. They cannot alter the nature of the system or overturn its general historical trends … Besides the inner logic of the system, exogenous factors are at work, which partially co-determine the system's development, at least at short- and medium-term ranges[19].

So far this is Mandel's standard explanation by Mandel. However, the paper added an important insight: the inner logic of the system is constrained by a parametric structure describing its possible trajectories, and that only major systemic events can change those settings.

> Hence any interaction between endogenous and exogenous forces is always limited by these parameters, by these constraints, it reaches its limits when it threatens to eliminate basic mechanisms of the system[20].

In this sense, the exogenous forces are not really independent and would be better described as 'partially autonomous variables', or, if we follow Kalecki's definition, as semi-autonomous. Both these contributions are, in my opinion, major contributions to the critique of the orthodox approaches to fluctuations, irregularities and cycles in historical processes, which are limited to the inquiry into equilibrating mechanisms disturbed by non-informative and meaningless 'white noise' shocks. Kalecki's and Mandel's views suggest that the analysis of complex phenomena is indeed irreducible to simplicity and that the reductionist approach is doomed to fail. Semi-autonomy, referring to non-linear interactions and modelling, incorporates what linear mathematics and formalization is unable to recognize - the constitutive complexity of social processes.

This unveils part of the enigma of long waves, which are very obvious specific periods of the history of capitalism. The traditional theories and statistical methods cannot detect those periods of structural change, since they are only suited to describing continuity, convergence and equilibrium, i.e., to ignoring history. The massive amount of empirical evidence included in *Late Capitalism* and summarized in *Long Waves of Capitalist Development* is instead a tour de force presenting the case for the systemic changes which are the very process of evolution of capitalism, namely its successive 'systems of machines', technological revolutions and social contradictions.[21] From that point of view, Mandel's research was a decisive scientific achievement.

Complexity and history

Mandel stressed the closeness of his own theory and that of Maddison, who studied the 'phases of capitalist development', although some differences remain in the adopted chronology. Both indicated that 'systemic shocks' are needed in order to create momentum for

a new expansive wave,[22] but Mandel was particularly concerned with the fact that some of these 'systemic shocks' imply the upswing and others the downswing.[23] From that point of view, it is evident that a strictly deterministic technological explanation is inaccurate, since the acceleration of technological innovation is not the single relevant factor in the increase in the organic composition of capital.

The mismatch between the techno-economic system and the socio-institutional one may prevent or extend the systemic impact of those changes, and social relations are therefore the ultimate determination of the process of undulatory development.

This vindicates again the incorporation of history into real life economics, i.e., political economy (or economics as a 'moral science') in the classical sense. Mandel's work was an example of such an approach, which he clearly presented as the project of exploring the integrated totality including internal economic factors, exogenous environmental changes and the mediation through socio-political developments. He was aware that such was the condition for the inquiry into the concrete dialectics of objective and subjective factors. The historical approach was thus reaffirmed: 'We can therefore accept the idea that the long waves are much more than just rhythmic ups and downs in the rate of growth of the capitalist economies. They are distinct historical periods in a real sense.'[24]

Mandel's theory, since it is based on the 'historical reality of the long wave [as] an integrated "total" character',[25] allows for a comprehensive explanation of those processes. There is indeed a trade-off between very simple and formal models which have a mathematical representation and therefore may be parametrized, and historical explanations or general theories which cannot be exhaustively modelled. Choosing the first avenue, many of the researchers become hostages of the available statistical methods, namely of the linear specifications which are needed to solve the equations, because normally even a very simple non-linear system cannot be solved. But only non-linear systems can mimic the real complexities of economies, such as the dynamic stability and simultaneous structural instability of these dissipative systems. The common methods of econometrics are based on an epistemological mistake and not only cannot explain but also cannot detect long waves or any type of historical processes.[20] The choice of the second option is therefore a sign of theoretical wisdom, and Mandel fought for such an alternative.

Quantitative and empirical research in the framework of the research programme on long waves is still in its infancy. Contradictory results on the long-term movement of the profit rate, such as those of Entov, Poletayev, Moseley, Duménil, Altvater or Shaikh, indicate that the methods are not robust, that there is a lack of information, and that the hypotheses are still being defined. Of course, the difficulties are immense, since conventional statistics is not suited to measurement in line with the Marxian concepts, and the theory is still not sufficiently developed to produce the conjectures to be tested. Some of these results are presented in Mandel's last book, and confirm at least that economies cannot be studied merely as an aggregate sum of factors, but that differences between branches are crucial in order to understand the evolution of profitability, the impacts of technological change and the profile of the mismatch between the social and economic subsystems.

In particular, Mandel's theory - and other models of the long waves based on the same type of assumptions - is centred on the concept of power or, more generally, of the coordinating aspect of economies and societies, which is at the heart of the pulsation of history, and this concept cannot be quantified. As a consequence, different combined methods are needed in order to understand real economies.

Capitalism may then be explained by two main tools: political economy, i.e., history, and the complexity approach, i.e., the formalization of the nonlinear, structurally unstable and

creative relations in economies. Both methods challenge the certainties of neoclassical economics and attack its equilibrium mystique. Their combination is needed in order to develop both the programme's analytical capacity and its ability to explain real evolutionary processes. Ernest Mandel's work is one of the building blocks for such a coming-together.

Notes

1. The main articles by Nikolai Kondratieff, his whole statistical tables and technical comments and indications have been published in French by Louis Fontvieille (N.D. Kondratieff, *Les Grands Cycles de la Conjoncture*, Paris 1992). An English edition, including a large collection of Kondratieff's works on other topics as well, is forthcoming, from Pickering & Chatto.

2. Leon Trotsky's report to the Comintern is published in *The First Five Years of the Communist International*, New York 1945, vol. 1, pp. 174-226. His critique of Kondratieff titled 'The Curve of Capitalist Development' can be found in *Problems of Everyday Life*, New York 1973, pp. 273-80.

3. Joseph Schumpeter, *Business Cycles*, New York 1939.

4. Van Gelderen only wrote one series of articles about long waves: 'Springvloed - Beschouwingen over Inclustrieele Ontwikkeling en Prijsbeweging' (1913) *Die Nieuwe Tijd*, no. 4, 5, 6, Amsterdam 1973. His ideas were developed later on by his friend De Wolff, but both wrote in Dutch and were generally unknown to their own and to the next generation of researchers. After publishing the paper, Van Gelderen did not write any more on the subject, and later on a tragic destiny interrupted his work (he committed suicide in 1940 when the Nazis invaded his country) and even the diffusion of his writings. Kondratieff and the other participants in the 1926 debate at the Moscow Conjuncture Institute did not know about the paper, which was not translated from Dutch and was published in English for the first time in Christopher Freeman, ed., *Long Wave Theory*, Aldershot 1996.

5. Alexander Parvus (1901), 'Die Handelskrisis und die Gewerkschaften' (Auszug), in Parvus et al., *Die langen Wellen der Konjunktur*, Berlin 1972.

6. His chronology of those changes in the trend was the following one: 1781-1851, 1851-1873, 1873-1894, 1894-1913,1913-... This corresponds closely to the chronologies by previous authors, namely the Italians or Van Gelderen, probably unknown to Trotsky. The coincidence of so many authors on the chronology, although working independently, suggests the distinctive features of the historical developments of nineteenth-century capitalism.

7. It is interesting to note one of the previous (and unrelated to the present theme) discussions on structural stability and the applicability of multiple correlation methods to real historical data. At the end of the thirties, John Maynard Keynes sharply criticized Jan Tinbcrgen for his use of econometric methods for a ten years series, 1922-33, since those methods suppose some form of structural stability during the period studied. One may add that those arguments are still more relevant if the hypothesis of structural stability is extended to two hundred years.

8. In normal economic series, there are reasons to expect non-stationarity (from the general growth and changes in mean and in variance), and also auto-correlation (from the historical features of the series) and heteroscedasticity (the variation of variance from the structural changes represented by different regimes). The traditional way to deal with these characteristics, in order to allow for statistical tests, are punitive methods against data: transformations in order to eliminate non-stationarity and auto-correlation, and some

weighting procedure in order to eliminate variations of variance. These methods are inadequate, lead to spurious results and contradict the evidence from historical analysis of real events. It is also significant that the two men who shared the first Nobel Prize (1969) in economics, Ragnar Frisch and Jan Tinbergen, awarded for their decisive contributions to the foundation of the econometric programme, both accepted and supported the hypothesis of long waves in spite of the inability of the traditional econometric methods to prove their existence. History was considered therefore an alternative and authoritative proof.

9. Simon Kuznets, 'Schumpeter's *Business Cycles',* in *American Economic Review* 30, 1940, pp. 257-71; Oskar Lange, 'Schumpeter's *Business Cycles',* in *Review of Economic Statistics* 23, 1941, pp. 190-93.

10. See the example of Metz, who most emphatically declares that the world wars are 'outliers' of the statistical series and should be eliminated and ignored (Rainer Metz, 'A Re-examination of Long Waves in Aggregate Production Series', in Kleinknecht, Mandel and Wallerstein, eds., *New Findings in Long Wave Research,* London 1992, p. 110).

11. Ragnar Frisch, 'Propagation Problems and Impulse Problems in Dynamic Economics', in K. Koch, eel., *Economic Essays in Honour of Gustave Cassel,* London 1933, pp. 171-205.

12. From this point of view, there is a contradiction between mainstream economic models (referring causality to the endogenous mechanism generating equilibrium, i.e., generating no events at all) and the positivist foundation of the programme (which refers causality to the exogenous variables). This paradox is evident in Schumpeter's work on cycles and long waves. Fie tried to solve it with an eclectic combination of historical insights on the creation of novelty, emerging from path-breaking innovations and challenging the state of equilibrium, and traditional concepts on the convergence to equilibrium. Therefore, change is endogenous to the working of the capitalist system in the Schumpeterian scheme.

13. *Late Capitalism,* London 1975, p. 42.

14. In a private letter to the author (3 March 1995), Mandel argued that those 'partially autonomous variables' reflected the uncertainty and complex determination of social evolution, under historical constraints. Therefore, the set of variables includes some political factors as well as those economic factors which are by themselves part of the social conflict and real history.

15. Michael Kalecki, 'Trends and Business Cycles Reconsidered', in *Economic journal* 78, 1968, pp. 262-76.

16. It is obviously the case of Marx's rate of profit, of Schumpeter's concept of innovation, or still of the three 'psychological laws' of Keynes (preference for liquidity, propensity to consume, the determinations of the marginal efficiency of capital). In orthodox macroeconomics the problem is also present, for instance under the form of the dual specification of investment as autonomous (exogenous) and induced (endogenous), therefore challenging the positivist requirement for unequivocal determination.

17. Thus Mandel tries to develop a unified theory of economic and social/political science, based upon a dialectical (parametrical) concept of determinism as opposed to a mechanistic one. Such a concept of determinism integrates into the economic and social processes the possibility, nay the inevitability, of choice - but choice within certain given constraints and choice, in the last analysis, determined by social interests which will remain conflicting ones unless a classless society can one day be established. Mandel, in Arestis, Sawyer, eds., *A Biographical Dictionary of Dissenting Economists,* Aldershot 1992, p. 340.

18. Neither the origin nor the content of this concept are very clearly stated. In a private letter to the author (9 September 1994), Mandel presented the concept as the expression of the uncertainty of the fight for social power. Presumably, the concept was influenced by some important contemporary researches in biology and thermodynamics. Writing in the early eighties, Levins and Lewontin argued that the stability of an evolutionary system depended on the balance of the feedback processes and the parameters governing the rate of evolution and defining its boundaries. At the same time, Prigogine and Stengers argued that the evolution of the parameters of a system could create chaos and complexity, and therefore new forms of order. Both notions are inspired by the early work of Poincaré on nonlinear systems, and an attentive reader of Mandel should notice the importance of those concepts for social sciences. The introduction of complexity, time, uncertainty, order and disorder, destroys the linear and equilibrium world of traditional economics, where convergence to equilibrium is presented as the desirable property of the system, in spite of representing its entropie death. 'Parametric determinism' stresses the nature of the causation and the boundaries of social evolution, and argues for new research methods. The importance of Mandel's contribution, applied to the study of historical economic processes, derives evidently from the fact that it anticipated these works.

19. 'Partially Independent Variables and Internal Logic in Classical Marxist Economic Analysis', first published in *Social Sciences Information* 14(3), 1985, pp. 485-505; reprinted in Himmelstrand, Ulf, eds., *Interfaces in Economic and Social Analysis,* London 1992, pp. 33-50. Quotes from 1992, p. 37.

20. Ibid., p. 39.

21. Like any anticipatory and global analysis, Mandel's has some flaws. Several critiques have pointed out that he considered the 'third technological revolution' (beginning after the Second World War) to consist of nuclear energy, the automation process and electronics (*Late Capitalism,* pp. 120-21), whereas it is evident today that the first generations of electronics were not as important as the diffusion of consumer durables. Today (micro)electronics is preparing the ground for a new long-wave transition. But, of course, *Late Capitalism was* published just one year after the creation of the micro-processor, and the economic impact of the latter was clear only in the eighties or nineties. On the other hand, Mandel keeps the date of 1968 as the end of the phase A of the fourth long wave, implying a priority for the political criterion, since the crisis of the international monetary system and the general recession marking the end of the postwar boom only occurred some years later.

22. Angus Maddison, *Dynamic Forces in Capitalist Development,* Oxford 1991; Mandel, *Long Waves of Capitalist Development,* London 1995, p. 141, n. 19.

23. *Late Capitalism,* p. 139.

24. *Long Waves,* p. 82.

25. Ibid., p. 76.

26. Francisco Louçã, *Turbulence in Economies,* Aldershot 1997.